A comparison of CERES and GEOS clear-sky fluxes

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The problem

- CERES calculates "clear sky" fluxes: what the flux would be if clouds were instantaneously removed
- important for calculating the effects of clouds
- "clear-sky" measurements from CERES are not pure measurements
- we would like to evaluate them

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JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 113, D17102, doi:10.1029/2008JD010137, 2008



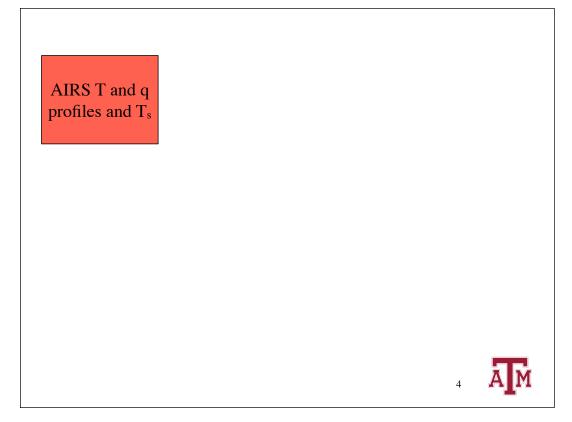
An analysis of the dependence of clear-sky top-of-atmosphere outgoing longwave radiation on atmospheric temperature and water vapor

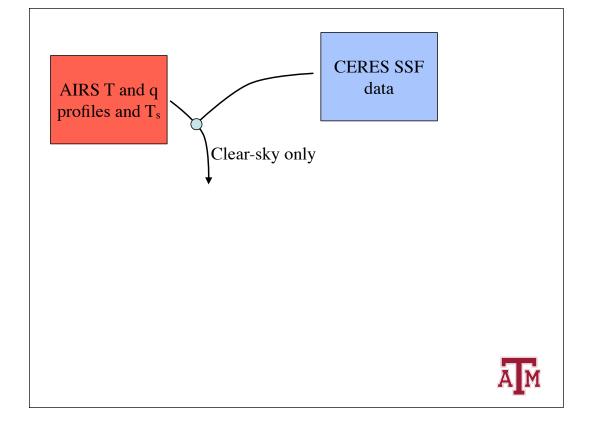
A. E. Dessler, P. Yang, J. Lee, J. Solbrig, Z. Zhang, and K. Minschwaner Received 17 March 2008; revised 9 June 2008; accepted 19 June 2008; published 3 September 2008.

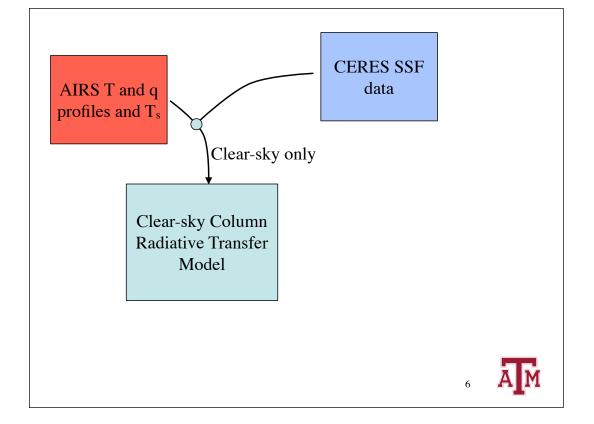
[1] We have analyzed observations of clear-sky top-of-atmosphere outgoing longwave radiation (OLR) measured by the Clouds and the Earth's Radiant Energy System (CERES). These measurements were obtained during March 2005 at night and over the ocean and cover latitudes from 70°N to 70°S. First, we compare the OLR measurements to OLR calculated from two radiative transfer models. The models use as input simultaneous and collocated measurements of atmospheric temperature and atmospheric water vapor made by the Atmospheric Infrared Sounder (AIRS). We find excellent agreement between the models' predictions of OLR and observations, well within the uncertainty of the measurements. We also analyze the sensitivity of OLR to changing surface temperature T_s, atmospheric temperature T_a, and atmospheric water vapor q. We find that OLR is most sensitive to unit changes in T_a when that change occurs in the lower

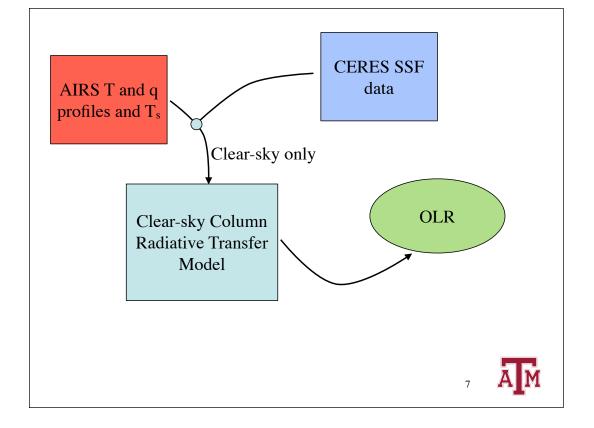


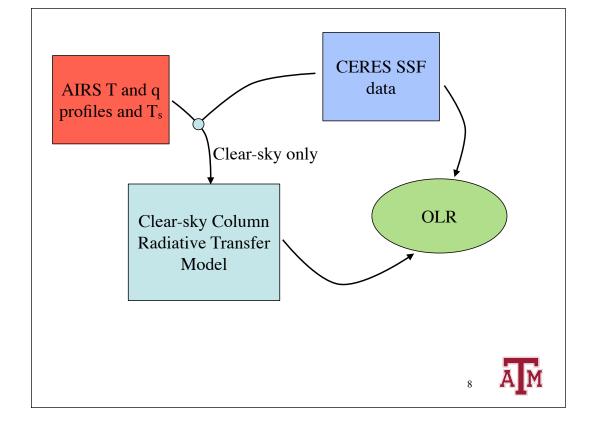
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Dessler et al., An analysis of the dependence of clear-sky top-of-atmosphere outgoing longwave radiation on atmospheric temperature and water vapor, J. Geophys. Res., 113, D17102, DOI: 10.1029/2008JD010137, 2008.

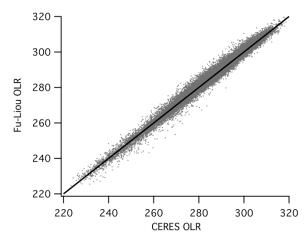
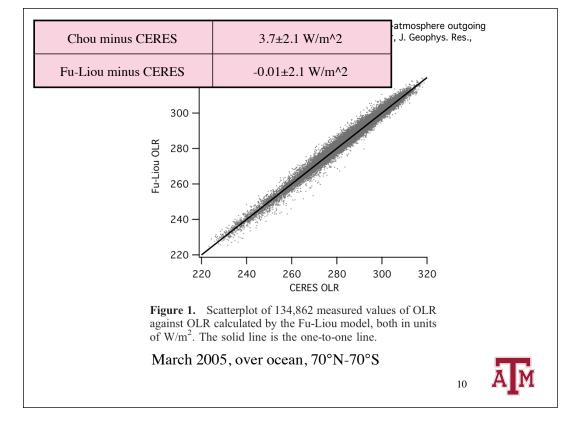
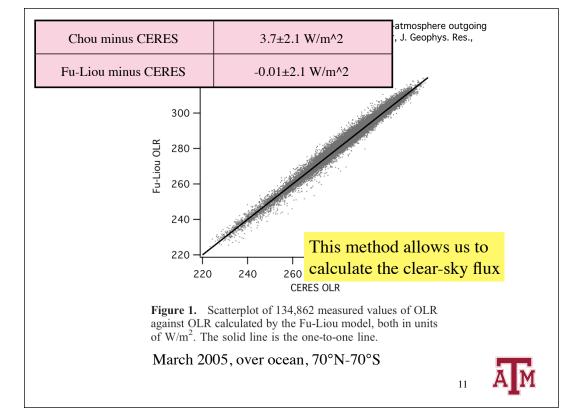


Figure 1. Scatterplot of 134,862 measured values of OLR against OLR calculated by the Fu-Liou model, both in units of W/m^2 . The solid line is the one-to-one line.

March 2005, over ocean, 70°N-70°S, nighttime

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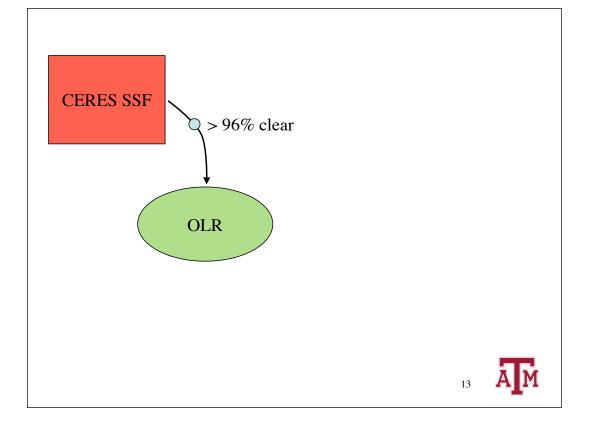


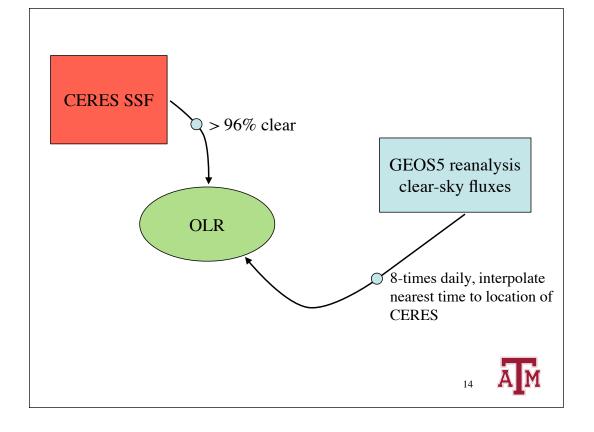


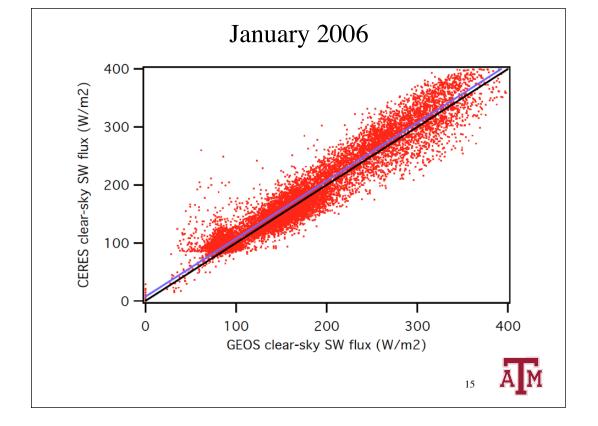
GEOS5 reanalysis

- Assimilates AIRS q and T fields
- GEOS5 reanalysis includes a clear-sky radiative flux calculation
- this flux is another way to verify clear-sky flux

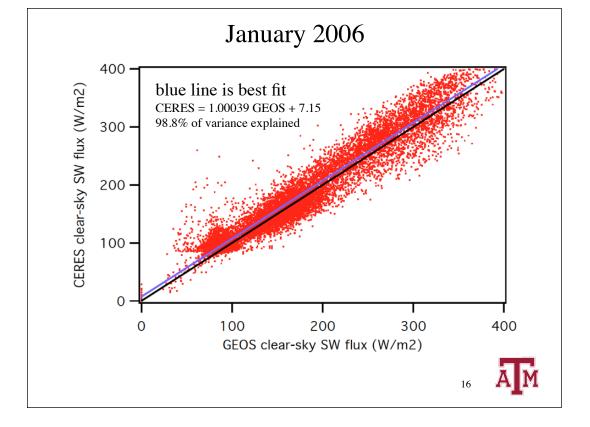




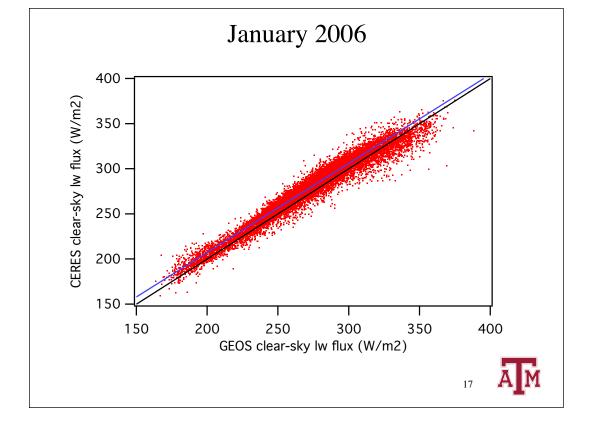




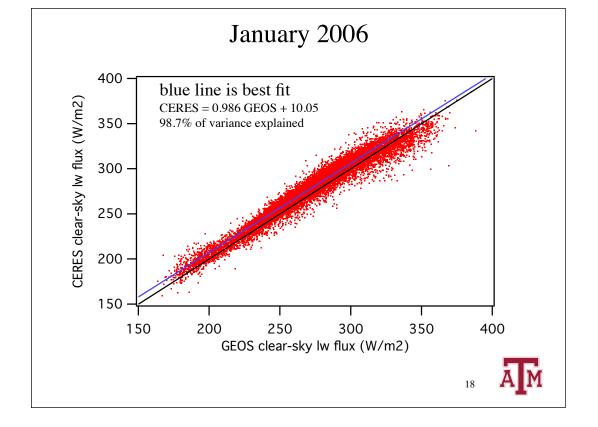
CERES 96% clear



constant offset between GEOS and CERES for SW



CERES 96% clear



SSF vs. GEOS

Table 1. CERES minus GEOS for clear-sky fluxes for January (W/m²)

January of	SW	LW
2004	7.37	4.82
2005	6.65	5.08
2006	7.53	5.48
2007	7.35	5.54

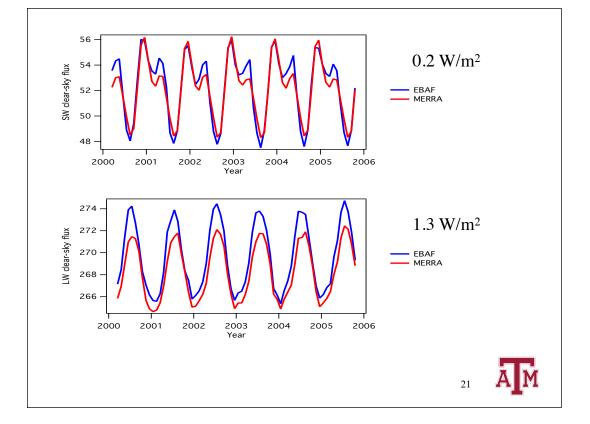
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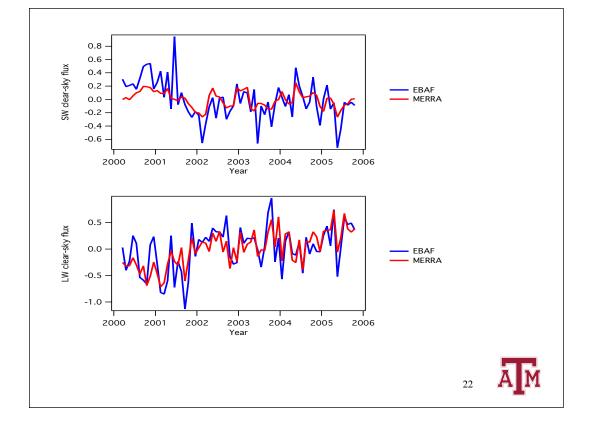
For SW, the avg. difference is similar to the intercept because the slope =1, for LW, the avg. difference is less because the slope is <1.

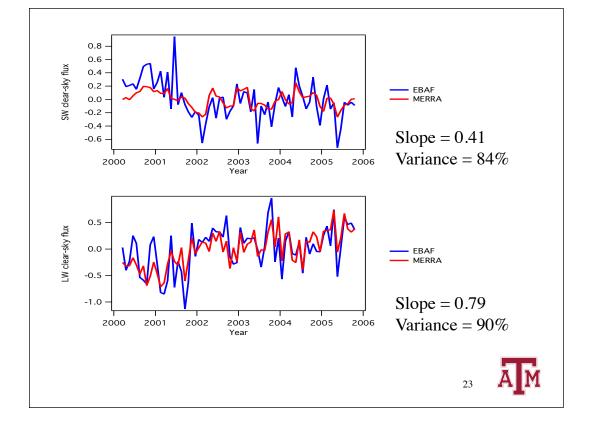
MERRA vs. EBAF

- Energy Balance and Fill
- CERES group's best estimate of TOA flux
- 3/2000-10/2005
- Compare monthly global average clear-sky fluxes from EBAF & MERRA





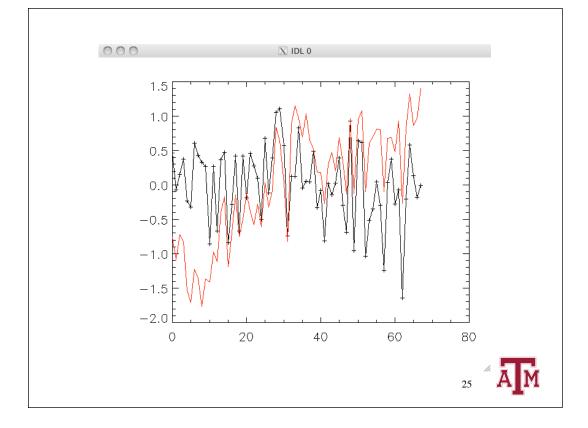




Conclusions

- Comparisons to reanalysis provide useful tests of measurements of TOA clear-sky fluxes
- Comparisons of MERRA vs. EBAF show
 - difference of clear-sky LW and SW shows distinct seasonal cycle
 - after removing the seasonal cycle, EBAF shows greater variations than MERRA in both LW and SW
 - EBAF and MERRA show similar interannual variations
- Next step: look at lat-lon differences

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all-sky LW+SW TOA upward flux for MERRA (red) and EBAF (black)